

## CLAIMS

1. A process for improving the separation of a feed gas comprised of at least carbon monoxide and hydrogen wherein the mixture is washed with liquid methane to separate, at least partially, a first carbon monoxide rich stream and a first hydrogen rich stream in a wash column, the first carbon monoxide rich stream is further separated into a second carbon monoxide rich stream, and the second carbon monoxide rich stream is stripped into a third carbon monoxide rich stream wherein the improvement comprises the step of:

withdrawing at least one second hydrogen rich stream from the wash column at a location intermediate of the first hydrogen stream and the first carbon monoxide stream.

2. The process of Claim 1 further comprising the step of withdrawing at least one methane rich stream from the wash column at a location intermediate of the hydrogen stream and the carbon monoxide stream.

3. The process of Claim 2 wherein at least a portion of the methane rich stream is fed to a flash column associated with the process.

4. The process of Claim 1 wherein the feed gas consists primarily of carbon monoxide and hydrogen.

5. The process of Claim 1 wherein the at least one second hydrogen rich stream is expanded to recover energy.

6. The process of Claim 1 wherein the at least one hydrogen rich stream is expanded to provide refrigeration.

7. The process of Claim 1 wherein the first carbon monoxide stream is split into a first and a second substream.

8. The process of Claim 7 wherein the first substream is subcooled and injected into another column.

9. The process of Claim 7 wherein the second substream is vaporized and injected into another column.
10. The apparatus of Claim 1 wherein the second hydrogen rich stream is about 15% to 50% of the total hydrogen flow contained in the syngas.
11. The apparatus of Claim 1 wherein a first hydrogen rich stream is withdrawn about an upper portion of the wash column.
12. The apparatus of Claim 11 wherein the first hydrogen rich stream is withdrawn with a carbon monoxide content of less than 1 ppm
13. The apparatus of Claim 1 wherein a third carbon monoxide rich stream is about 92 percent to about 99 percent by volume of the carbon monoxide in the feed gas.
14. An apparatus for the separation of carbon monoxide gas and hydrogen from a gaseous mixture comprising:
- a methane wash column;
  - a hydrogen flash column;
  - a carbon monoxide/methane distillation column;
  - at least one conduit means for feeding a feed gas comprising at least carbon monoxide and hydrogen to the wash column;
  - at least one conduit means for feeding a first carbon monoxide rich stream from the wash column to the at least one location about the flash column;
  - at least one conduit means for feeding a second carbon monoxide rich stream from the flash column to the stripping column; and,
  - the at least one conduit means provided intermediate on the wash column for withdrawing a second hydrogen stream.
15. The apparatus of Claim 14 further comprising at least one second conduit means for

withdrawing at least one methane enriched stream from the wash column and injecting the at least one methane enriched stream into the flash column.

16. The apparatus of Claim 14 wherein the at least one conduit means for feeding a second carbon monoxide rich stream from the flash column to at least one location about the distillation column comprises a first and a second conduit means whereby the second stream is divided into a first substream and a second substream.

17. The apparatus of Claim 16 wherein the first substream is injected at a location about the distillation column and the second substream is injected at a location on the distillation column below the first substream.

18. The apparatus of Claim 14 further comprising an expander connected to the conduit means for extracting the second hydrogen product.

19. A process for separating a carbon monoxide stream from a feed gas comprising at least carbon monoxide and hydrogen comprising the steps of:

separating a third carbon monoxide rich stream from the feed gas in a system comprising a wash column, a flash column, and a stripping column wherein the feed gas is separated into a first carbon monoxide rich stream, a first hydrogen rich stream, and a second hydrogen rich stream in the wash column, the first carbon monoxide rich stream is further separated into a second carbon monoxide rich stream in the flash column, the second carbon monoxide rich stream is further separated into a third carbon monoxide rich stream in the stripper column whereby the volume of the carbon monoxide in the third carbon monoxide rich stream is about 92% to about 99% of the volume of the carbon monoxide in the feed gas and the extraction of the second hydrogen rich stream reduces an amount of methane required to wash the feed gas.